UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
08/941,832	10/01/97	CHACON	G	80000054

TM21/0910

RONALD P. KANANEN, ESQ.
RADER, FISHMAN AND GRAUER P.L.L.C.
1233 20TH STREET, NW,
SUITE 501
WASHINGTON DC 20036

EXAMINER	
JONES, H	
ART UNIT	PAPER NUMBER
2123	#27

DATE MAILED: 09/10/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

#17

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 24

Application Number: 08/941,832
Filing Date: October 1, 1997
Appellant(s): Chacon

MAILED
SEP 1 0 2001
Technology Center 2100

Ronald P. Kananen
For Appellant

EXAMINER'S ANSWER

This is in response to appellant's brief on appeal filed 5/31/2001.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

- ***the 112(2) "essential elements" rejections have been withdrawn against claims 41-50.*** *All other rejections are maintained; i.e., claims 37-50 are finally rejected.*

Furthermore, the Examiner objects to the "history" of prosecution (i.e., indication of earlier allowable claims, etc.) which appears to be an attempt to introduce an *argument* or *allusions* and is irrelevant as it relates to "*Status of Claims*".

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is substantially correct. Furthermore, the Examiner objects to the "history" of prosecution which appears to be argumentative in nature (i.e., "*...the Examiner found the arguments presented therein unpersuasive...*"), introduces allusions and is irrelevant as it relates to "*Status of Amendments After Final*".

(5) Summary of Invention

The summary of invention contained in the brief is not fully agreed with for the following reasons. Appellants have not specifically mapped the claims to the "*Summary of the Invention*". MPEP section 1200 recites, in part:

> Summary of Invention. A concise explanation of the invention defined in the claims involved in the appeal. This explanation is required to refer to the specification by page and line number, and, if there is a drawing, to the drawing by reference characters. Where applicable, *it is preferable to read the appealed claims on the specification and any drawing*. While reference to page and line number of the specification may require somewhat more detail than simply summarizing the invention, *it is considered important to enable the Board to more quickly determine where the claimed subject matter is described in the application*.

Furthermore, the Examiner objects to the recitation which appears to be argumentative in nature (i.e., last three lines, page 3, Appeal Brief), introduces allusions and is irrelevant as it relates to "*Summary of the Invention*".

(6) Issues

The appellant's statement of the issues in the brief is not agreed with for the following reasons.

- the listing of the various issues is not agreed with because it relies on a grouping of claims which is not agreed with. The appellant's statement in the brief that certain claims do not stand or fall together is not agreed with. Section 1200 provides guidance:

> (7) Grouping of Claims. For each ground of rejection which appellant contests and which applies to a group of two or more claims, the Board shall select a single claim from the group and shall decide

the appeal as to the ground of rejection on the basis of that claim alone, unless a statement is included that the claims of the group do not stand or fall together and, in the argument section of the brief (37 CFR 1.192(c)(8)), appellant explains why the claims of the group are believed to be separately patentable. ***Merely pointing out differences in what the claims cover is not an argument as to why the claims are separately patentable***. If an appealed ground of rejection applies to more than one claim and appellant considers the rejected claims to be separately patentable, 37 CFR 1.192(c)(7) requires appellant to state that the claims do not stand or fall together, ***and to present in the appropriate part or parts of the argument under*** 37 CFR 1.192(c)(8) the reasons why they are considered separately patentable. The absence of such a statement ***and argument*** is a concession by the applicant that, if the ground of rejection were sustained as to any one of the rejected claims, it will be equally applicable to all of them. 37 CFR 1.192(c)(7) is consistent with the practice of the Court of Appeals for the Federal Circuit indicated in such cases as In re Young, 927 F.2d 588, 18 USPQ2d 1089 (Fed. Cir. 1991); In re Nielson, 816 F.2d 1567, 2 USPQ2d 1525 (Fed. Cir. 1987); In re King, 801 F.2d 1324, 231 USPQ 136 (Fed. Cir. 1986); and In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed. Cir. 1983). 37 CFR 1.192(c)(7) requires the inclusion of reasons in order to avoid unsupported assertions of separate patentability. The reasons may be included in the appropriate portion of the "Argument" section of the brief. For example, if claims 1 to 4 are rejected under 35 U.S.C. 102 and appellant considers claim 4 to be separately patentable from claims 1 to 3, he or she should so state in the "Grouping of claims" section of the brief, and then give the reasons for separate patentability in the 35 U.S.C. 102 portion of the "Argument" section (i.e., under 37 CFR 1.192(c) (8) (iii)). In the absence of a separate statement that the claims do not stand or fall together, the Board panel assigned to the case will normally select the broadest claim in a group and will consider only that claim, even though the group may contain two broad claims, such as "ABCDE" and "ABCDF.". The same would be true in a case where there are both broad method and apparatus claims on appeal in the same group. ***The rationale behind the rule, as amended, is to make the appeal process as efficient as possible***. Thus, while the Board will consider each separately argued claim, the work of the Board can be done in a more efficient manner by selecting a single claim from a group of claims when the appellant does not meet the requirements of 37 CFR 1.192(c)(7). It should be noted that 37 CFR 1.192(c)(7) requires the appellant to perform two affirmative acts in his or her brief in order to have the separate patentability of a plurality of claims subject to the same rejection considered. The appellant must (A) state that the claims do not stand or fall together and (B) present arguments why the claims subject to the same rejection are separately patentable. Where the appellant does neither, the claims will be treated as standing or falling together. Where, however, the appellant (A) omits the statement required by 37 CFR 1.192(c)(7) yet presents arguments in the argument section of the brief, or (B) includes the statement required by 37 CFR 1.192(c)(7) to the effect that one or more claims do not stand or fall together (i.e., that they are separately patentable) yet does not offer argument in support thereof in the "Argument" section of the brief, the appellant should be notified of the noncompliance as per 37 CFR 1.192(d). Ex parte Schier, 21 USPQ2d 1016 (Bd. Pat. App. & Int. 1991); Ex parte Ohsumi, 21 USPQ2d 1020 (Bd. Pat. App. & Int. 1991).

Appellants have never previously argued the claims as other than a single group. Please refer to pages 9-29, paper # 22. Appellants also refer to a single group in the Statement of the "*Issues*" (pp. 4-6, Appeal Brief). Furthermore, Appellants have provided not presented any rationale or explanation for their grouping in the sections entitled "Grouping of Claims" or in "Arguments". In the "Arguments" section, Appellants have essentially only *recited the prior art teaching* followed by a *recitation of the claims* without pointing out the *patentable distinction.* Therefore, the Examiner considers the claims as a *single group*.

The correct statement of the issues (noting that ***the 112(2) "essential elements" rejections have been withdrawn against claims 41-50***) is:

- Claims 37-40 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements.

Claims 37-50 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps.

Claims 37-50 provides for the use of *controlling a manufacturing line*, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass.

Claims 37-50 are rejected under 35 U.S.C. 102(a) as being clearly anticipated by De Toni et al..

Claims 37-50 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Umeda et al. (U. S. Patent 5,544,348 - of record) or Seppanen (IEEE, 1993 - of record) or Wiwakanond et al. (of record) or Corbett et al. (of record) or Tantry et al. (of record) or Natarajan (of record) or Parad (of record) or Korncoff et al. (of record) or Weaver et al. (of record) or Lee et al. (of record) or Liberatore et al. or Jain et al. or Roberts et al. or Umeda (IEEE) or Bouchentouf-Idriss et al. or Harmonosky or Marriott or Krishnamurthi et al. or Manivannan et al..

(7) Grouping of Claims

The appellant's statement in the brief that certain claims do not stand or fall together is not agreed with for the following reasons.

The appellant's statement in the brief that certain claims do not stand or fall together is not agreed with. Section 1200 provides guidance (*see earlier recitation*).

Appellants have never previously argued the claims as other than a single group. Please refer to pages 9-29, paper # 22. Appellants also refer to a single group in the Statement of the "*Issues*" (pp. 4-6, Appeal Brief). Furthermore, Appellants have ~~provided~~ not presented any rationale or explanation for their grouping in the sections entitled "Grouping of Claims" or in "Arguments". In the "Arguments" section, Appellants have essentially only *recited the prior art teaching* followed by a *recitation of the claims* without pointing out the *patentable distinction*. Therefore, the Examiner considers the claims as a *single group*.

(8) ***Claims Appealed***

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) ***Prior Art of Record***

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

5,247,447	Korncoff et al.	9-1993
5,398,336	Tantry et al.	3-1995
5,544,348	Umeda et al.	8-1996
5,369,570	Parad	11-1994
5,446,671	Weaver et al.	08-1995
4,866,628	Natarajan	9-1989
5,089,970	Lee et al.	2-1992

Wiwakanond et al. "Simulation of Electronics Manufacturing with Two-Card Kanban." System Theory, 1996 (March 31, 1996), pp. 391-395.

Seppanen, M.S. "Kanban Simulator using Siman and Lotus 1-2-3." Winter Simulation Conference Proceedings 1993 (December, 1993), pp. 838-844.

Corbett et al. "Modeling Just-In-Time Production Systems: A Critical Review." Winter Simulation Conference Proceeding 1993 (December, 1993), pp. 819-828.

Krishnamurthi et al. "Domain-Based On-Line Simulation for Real-Time Decision Support" Winter Simulation Conference Proceedings 1993 (December, 1993), pp. 1304-1312.

De Toni et al. "An Artifical, Intelligence-Based Production Scheduler" Integrated Manufacturing Systems, (July, 1996), pp. 17-25.

Liberatore et al. "Dynamic Allocation of Kanbans in a Manufacturing System Using Pertubation Analysis." Proc. ETFA '95 (October, 1995), pp. 595-603.

Jain et al. "Expert Simulation for On-Line Scheduling." Winter Simulation Conference Proceedings (December, 1989), pp. 930-935.

Roberts et al. "Object Oriented Simulation Tools Necessary for a Flexible Batch Process Management Architecture." 1991 Winter Simulation Conference Proceedings (December, 1991), pp. 323-330.

Umeda "A Manufacturing-Oriented Simulation Package to Support Systems Planning and its Operation." 1992 Winter Simulation Conference Proceedings (December, 1992), pp. 890-898.

Bouchentouf-Idriss et al. "Designing a Kanban Manufacturing System Using the Server Network Generator (SNG) CASE Tool." ACM 0-89791-441-4/91/0008/0062 (December, 1995) (April, 1991), pp. 62-70.

Harmonsky "Simulation-Based Real-Time Scheduling: Review of Recent Developments." 1995 Winter Simulation Conference Proceddings (December, 1995), pp. 220-225.

Marriot "Production Scheduling Systems Using Provisa" 1994 Winter Simulation Conference Proceedings (December 1994), pp. 522-526.

Manivannan et al. "Real-Time Control of a Manufacturing Cell Using Knowledge-Based Simulation." 1991 Winter Simulation Conference Proceedings (December 1991), pp. 251-260.

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims (for convenience, the Examiner will refer to locations of recited passages instead of reciting the passages - said passages will be recited as necessary in the section *Response to Arguments*):

Claims 37-40 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01.

- simulator: the simulator has not been described;

- production scheduling model: this has not been described.

- virtual/electronic Kanban: this has not been described.

Claims 37-50 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are:

- simulation: the steps have not been described.

- determine the validity of the Kanban: how is this done?

- controlling a manufacturing line: how is this done?

- claim 37: what happens if the Kanban is not determined to be valid?

Claims 37-50 provides for the use of *controlling a manufacturing line*, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass. A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced. There are no limitations directed at anything more than generation of a schedule.

Claims 37-50 are rejected under 35 U.S.C. 102(a) as being clearly anticipated by De Toni et al..

See: abstract; pp. 22-23 (hybrid push/pull approach); pg. 23 (expert system).

Claims 37-50 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Umeda et al. (U. S. Patent 5,544,348 - of record) or Seppanen (IEEE, 1993 - of record) or Wiwakanond et al. (of record) or Corbett et al. (of record) or Tantry et al. (of record) or Natarajan (of record) or Parad (of record) or Korncoff et al. (of record) or Weaver et al. (of record) or Lee et al. (of record) or Liberatore et al. or Jain et al. or Roberts et al.

or Umeda (IEEE) or Bouchentouf-Idriss et al. or Harmonosky or Marriott or Krishnamurthi et al. or Manivannan et al..

Umeda et al. teaches simulation of a Kanban system. See entire disclosure and particularly: abstract; figs. 1-15; col. 1, lines 42-55; col. 3, lines 48-67; col. 3, lines 1-48; col. 10 lines 1-67; col. 18, lines 10-67.

Seppanen teaches: "Kanban Simulator using Siman and Lotus 1-2-3." See particularly: abstract; and pp. 838-844.

Wiwakanond et al. teach "Simulation of Electronics Manufacturing Systems with Two-Card Kanban." See particularly: entire disclosure.

Corbett et al. disclose a review of papers concerning simulations of scheduling systems, including Kanban systems. See particularly: abstract; sections 2-3, and list of references.

Tantry et al. disclose "*Object-oriented architecture for factory floor management.*" See: abstract; fig. 2-3, 5-10; col. 1, line 38 to col. 2, line 46; col. 5, line 45 to col. 9, line 30; Table 1 (col. 20).

Natarajan discloses a *conceptual decision analysis tool for production dispatch process.* See: abstract; fig. 2-3; col. 2, line 26 to col. 3, line 10.

Parad discloses (abstract): *A method for continuous real-time management of heterogeneous interdependent resources.* See: abstract; fig. 1-2, 6, 8-9, 11-12, 17-19; col. 2, line 1 to col. 5, line 64.

Korncoff et al. discloses An exception *processing system for use in conjunction with manufacturing facilities, and automated manufacturing cells.* See: abstract; fig. 1-2, 5, 7, 12, col. 1, lines 24-46; col. 2, line 1 to col. 4, line 23.

Weaver et al. discloses a look-ahead method for determining *optimum production schedules* for each production step based on factory-wide monitoring of in-process part queues at all potential production bottlenecks. See: abstract; fig. 3; col. 1, line 16 to col. 2, line 26.

Lee et al. discloses a lookahead production planning system. See: abstract; fig. 1, 3-4, 6, 15-16, 18-20, 23-28; col. 3, line 60 to col. 6, line 27.

Liberatore et al. disclose "*Dynamic allocation of kanbans in a manufacturing system using perturbation analysis.*" See: abstract; section 1 which discusses an on-line control strategy (developed in section 4).

Jain et al. disclose "*Expert Simulation For On-line Scheduling.*" See: abstract; section 2 (expert systems approach); section 3 (use of simulation); and fig. 1-2 (implementation of combined on-line system).

Roberts et al. discloses in section 5 (*CONTROL SPECIFICATION SIMULATION ASSISTANT*) that often control code errors am not detected until the code is tested on the actual process. See fig. 1; section 5 (control specification simulation assistant).

Umeda discloses in section 6 (*ADVANCED SIMULATION SYSTEM FOR PRODUCTION PLANNING AND CONTROL SYSTEM*) that thus far, the author have suggested a manufacturing system simulator. In this section, Umeda proposes an advanced simulation

system, which includes the above simulator as its a kernel module. See pg. 892 (Kanban, Pull); section 2.4 (Siman); section 6 (real-time simulation and process control)

Bouchentouf-Idriss et al. disclose a manufacturing engineering application, a concurrent cooperative processing model of this application, and the Server Network Generator (SNG) CASE tool that was used to *design and implement it as a distributed software system* in APL2, using inter-user shared variables. The application is a Japanese manufacturing control strategy called the "*Kanban System.*" See pp. 62-66 (Kanban); pp. 66-68 (electronic Kanban, emulation);

Harmonosky discloses in section 2 (SIMULATION INTERFACED WITH THE PHYSICAL SYSTEM) that in most of the reported research using ***simulation for real-time scheduling, the simulation is assumed to be interfaced with the physical system in some manner.*** See fig. 1, section 2.

Marriott discloses in section 1.1 (*TRADITIONAL SCHEDULING*). See fig. 1 & 4 and section 1.1.

Krishnamurthi et al. disclose the state of the prior art regarding on-line simulation in section 2 (*PAST RESEARCH ON ON-LINE SIMULATION SYSTEMS*). See fig. 1-3.

Manivannan et al. disclose "***Real-time control of a manufacturing cell using knowledge-based simulation.***" See abstract; fig. 1 & 6 (real-time control, feedback and simulation).

(11) Response to Argument

A few introductory remarks are first presented. These remarks relate to various themes relating to general allegations of an improper examination that Appellants have attempted to develop in the Appeal Brief and which are interleaved throughout the Appeal Brief.

1) ***Appellants have misinterpreted passages from the MPEP.*** Appellants repeatedly state (see Appeal Brief: pp. 13-14, pp. 15-16) that:

"Appellant notes that this is not a proper §112, second paragraph rejection, which would address indefiniteness. MPEP §2172.01, which is cited in the Office Action for authority, exclusively addresses §112, first paragraph rejections. Accordingly, Applicant is uncertain what the Office Action is stating, thereby making this rejection confusing, and accordingly this rejection is improper, and should not be sustained."

In contrast, MPEP §2172.01 recites:

"2172.01 Unclaimed Essential Matter

A claim which omits matter disclosed to be essential to the invention as described in the specification or in other statements of record may be rejected under 35 U.S.C. 112, first paragraph, as not enabling. In re Mayhew, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). See also MPEP § 2164.08(c). Such essential matter may include missing elements, steps or necessary structural cooperative relationships of elements described by the applicant(s) as necessary to practice the invention."

In addition, a claim which fails to interrelate essential elements of the invention as defined by applicant(s) in the specification ***may be rejected under 35 U.S.C. 112, second paragraph,*** *for failure to point out and distinctly claim the invention*. See In re Venezia, 530 F.2d 956, 189 USPQ 149 (CCPA 1976); In re Collier, 397 F.2d 1003, 158 USPQ 266 (CCPA 1968)."

2) **Application of the best prior art:** Appellants have complained that (pp. 19-21, Appeal Brief) the Examiner should only apply the best prior art, and concludes that the 102 rejections should therefore not be sustained. This appears to be the first time Appellants have raised this issue. First, the Examiner respectfully points out that Appellants have previously responded to all the rejections without complaint. Second, the Examiner only applied a few of many possible rejections, and in fact has only applied the *best art*, against Appellant's claims. Appellants assertions are *conclusory* in the lack of credible *evidence* to the contrary. As per 37 C.F.R. 1.104 (c), referred to on pg. 20 of the Appeal Brief, Appellants have not offered arguments that either the references are complex or that the pertinence of each reference is not apparent. Examiner does not believe this application raises to the level of "complex" especially knowing Applicants' and Assignees' relative level of experience in the field (note the co-pending appeal brief). The Examiner respectfully submits that it is late in the process to be raising this issue. The Examiner also notes that the Examiner had previously requested that Appellants supply any prior art of which they are aware a (see paragraphs 1-2, paper # 21) as per indications of such art in the specification (page 2 and first paragraph, page 3). ***Appellants have not acknowledged or responded to said request.***

3) **Omissions of Facts that Improperly Characterize the Record**: Appellants have referred to the Examiner's rejection in such a manner as to improperly characterize the record. For example, see pg. 29, first full paragraph. In building support for the allegation that the Examiner has not provided "specificity", Appellants recite "See particularly ... list of references." Appellants' follow this up with the conclusion that "*Referring to a list of references is NOT a showing of specificity within the reference*". However, the conclusion is based on omission of facts that improperly characterize the record.

Compare this recitation with the ***complete rejection*** (paragraph 15, paper # 21), "*Corbett et al. disclose a review of papers concerning simulations of scheduling systems, including Kanban*

systems. *See particularly:* ***abstract; sections 2-3****, and list of references*." Appellants have ignored the emphasis on the portions which Appellants have omitted, namely, the ***abstract*** and ***sections 2-3***. In point of fact, the Examiner had directed Appellants' attention to the list of references in an attempt to point out to Appellants the abundance of research in the art.

4) Appellants' reference to a suppossed acknowledgement by the Examiner (Appeal Brief: page 28, second paragraph; page 44, second paragraph). This is ***hearsay***. The Examiner has made no such statement and Appellants are asked to withdraw said allegation or provide ***evidence*** of such an acknowledgement by the Examiner. ***The Representative was provided the courtesy of a two-hour interview in an attempt to resolve the outstanding issues in the co-pending applications and objects to such mischaracterization.***

In fact, the Examiner did repeatedly attempt (*during the interview and throughout prosecution of the instant application*) to impress upon Appellants that the claims were broad and, as such, were disclosed in the prior art. The Examiner also repeatedly attempted to suggest allowable material, namely details of the simulator, as disclosed in the specification.

5) Allegations that the Examiner has misinterpreted the invention: Appellants have also complained that the Examiner has misinterpreted the invention and conclude that the 102 rejections should not be sustained (Pg. 21, for example). The Examiner respectfully disagrees. The Examiner interprets the invention to be: ***real-time (in the specification - but not claimed) optimization of a production routing schedule using stored feedback data as input to a simulator***. The Examiner also interprets *electronic/virtual Kanban* to be electronic tracking of items in a manufacturing line. These concepts have been disclosed in the prior art. Appellants have referred to their Summary of the Invention. However, Appellants have not explained the ***patentable difference*** between the ***claim and said interpretation***. The Examiner respectfully does not see the patentable distinctions as per

Appellants definitions (in the specification) of claimed features. Furthermore, as noted, *the Summary is not agreed with by the Examiner for reasons presented earlier.*

6) Allegations that the Examiner has attempted to introduce extra references, not of record, into the rejections: Appellants further allege that the Examiner has not responded a request that the "*extra references*" be supplied and addressed individually. These allegations appear on pg. 19 ((iii) 35 U.S.C. §102); pg. 22 ((iii)(1) 35 U.S.C. §102); pg. 27 ((iii)(5) 35 U.S.C. §102); pg. 43 ((iii)(17) 35 U.S.C. §102); ; pg. 46 ((iii)(19) 35 U.S.C. §102). Appellants are referring to references which themselves refer to other references (such as "Review" papers, journal papers, conference papers and ***issued patents***). The Examiner ***responded to the request*** relating to this issue. Please see paper # 23 (Advisory Action) in which the Examiner stated that he was not aware of any legal basis for Appellants' position. The Examiner respectfully submits that the issue can be simply analyzed by addressing the elements of 102 (a) and 102 (b). The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (a) the invention was known or used by others in this country, or patented or ***described in a printed publication in this or a foreign country***, ***before the invention thereof by the applicant for a patent***.
>
> (b) the ***invention*** was ***patented or described*** in a ***printed publication*** in ***this or a foreign country*** or in public use or on sale in this country, ***more than one year prior*** to the date of application for patent in the United States.

- Consider the "De Toni et al." reference. This is a description in a printed publication in this or a foreign country, before the invention thereof (i.e., 1996) by the applicant for a patent.

- Consider the "Corbett et al." reference. This is a *description in a printed publication* in *this or a foreign country* and was printed in *1993 - more than one year prior to Appellants' date of application for patent in the united States*.

- Consider the "Harmonosky et al." reference. This is a *description in a printed publication* in *this or a foreign country* and was printed in 1995 - *more than one year prior to Appellants' date of application for patent in the united States*.

- Consider the "Krishnamurthi et al." reference. This is a *description in a printed publication* in *this or a foreign country* and was printed in *1993 - more than one year prior to Appellants' date of application for patent in the united States*.

The publications in question meet the criteria as required under 35 U.S.C. 102 as recited above.

7) Allegations regarding improper or deficient examination: These allegations are presented or alluded to throughout the entire Appeal Brief): Applicants have generally not actually addressed the *merits* of the prior art rejections. Applicants appear to focus on whether certain phrases are present in the prior art, and on attempts to render the rejections somehow procedurally deficient (see, for example, pp. 19-21); the important issue is whether the prior art has previously disclosed Applicant's *invention*.

In response to these statements and Applicants' statement that the art did not *anticipate* or *render obvious* and allegations that in someway the prior office action was defective in asserting of the prior art against the claims, Examiner can only respond by stating the Applicants are presumed to be at least one(s) of ordinary skill in the art (note the *co-pending appeal brief*) and therefore should understand the prior art teachings as they apply to the claims at hand. The 102 rejections were intentionally structured to recite *anticipated*.

MPEP explicitly states: "A **prima facie** case of unpatentability is established when the information compels a conclusion that a claim is **unpatentable under the preponderance of evidence**, burden-of-proof standard, giving each term in the claim its **broadest reasonable construction consistent with the specification**, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability" and "An application should not be allowed, unless and until issues pertinent to patentability have been raised and resolved in the course of examination and prosecution, since otherwise the resultant patent would not justify the statutory presumption of validity (35 U.S.C. 282), nor would it "strictly adhere" to the requirements laid down by Congress in the 1952 Act as interpreted by the Supreme Court. The **standard** to be applied in all cases is the **"preponderance of the evidence"** test. In other words, **an examiner should reject a claim if, in view of the prior art and evidence of record, it is more likely than not that the claim is unpatentable** and "In rejecting claims for want of novelty or for obviousness, the **examiner must cite the best references at his or her command**. When a reference is *complex* or shows or describes inventions other than that claimed by the applicant, the particular part relied on must be designated as nearly as practicable. The pertinence of each reference, ***if not apparent***, must be clearly explained and each rejected claim specified". Examiner does not believe this application raises to the level of "complex" especially knowing Applicants' and Assignees' relative level of experience in the field (note the co-pending appeal brief).

Anticipation is a question of fact. *In re King, 801 F.2d 324, 231 USPQ 136 (Fed. Cir. 1986)*. The inquiry as to whether a reference anticipates a claim must focus on what subject matter is encompassed by the claim and what subject matter is described by the reference. As set forth by the court in *Kalman v. Kimberly-Clark Corp. , 713 F.2d 760, 218 USPQ 781, 789 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984)*, it is only necessary for the claims to " 'read on' something disclosed in the reference, i.e., all limitations in the claim are found in the reference, or 'fully met'

by it."Where, as here, a reference describes a class of compositions, the reference must be analyzed to determine whether it describes a composition(s) with sufficient specificity to constitute an anticipation under the statute. See *In re Schaumann 572 F.2d 312, 197 USPQ 5 (CCPA 1978). (reciting from: Ex parte Lee, BPAI at 31 USPQ2d 1105)*

The *prima facie case* is a procedural tool which, as used in patent examination (as by courts in general), means not only that the evidence of the prior art would reasonably allow the conclusion the examiner seeks, but also that ***the prior art compels such a conclusion if the applicant produces no evidence or argument to rebut it***. See Black's Law Dictionary 1071 (5th Ed. 1979). See generally *In re Piasecki, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984)* (citing cases showing the evolution of the concept in patent examination of prima facie obviousness as a legal inference drawn from uncontradicted evidence) (reciting from *In re Spada (CAFC) 15 USPQ2d 1655 (8/10/1990)*). Especially in view of the fact that the courts have held that ***"A reference anticipates a claim if it discloses the claimed invention such that a skilled artisan could take its teachings in combination with his own knowledge of the particular art and be in possession of the invention."*** *In re Graves, 36 USPQ2d 1697 (Fed. Cir. 1995); In re Sase, 207 USPQ 107 (CCPA 1980); In re Samour, 197 USPQ 1 (CCPA 1978).*

Prima facie means at first sight, on the first appearance, on the face of it, so far as can be judged from the first disclosure, presumably or a fact presumed to be true unless disproved by some evidence to the contrary. ***Prima facie case is made when such will prevail until contradicted and overcome by other evidence or which has proceeded upon sufficient proof to that stage where it will support finding if evidence to the contrary is disregarded***. (*recited from: Black's Law Dictionary, 5th Edition*) A prima facie case can be made by the Examiners' assertion of the prior art associated with the pending claims that would render the claims unpatentable. As to the allowability or patentability of Applicants' claimed invention, only a "preponderance of the evidence" needs to be applied to make

the determination of the allowability or patentability of pending claims. The Examiner notes that Applicants *have not shifted the burden to the Examiner in response the prima facie showing.*

Consider the arguments (for example, pages 43-45) against the 102 Harmonosky rejection:

- a) Appellants opine that *a review paper can not be used as prior art* (pp. 43) and conclude that the 102 rejection was improper;

- b) Appellants argue that a review paper "*does not disclose or teach anything*" (pg. 44);

- c) Appellants *inaccurately attribute admissions to the Examiner* (pg. 44);

- d) Appellants resort to a *conclusory statement* which is based on 1-3, above (i.e., "*Accordingly...*" - pg. 44, second paragraph);

- e) the *only possible argument of substance* begins in the second full paragraph (pg. 44, second paragraph) wherein Appellants refer to specific words in the claims. However, Appellants have not actually discussed the disclosure of Harmonosky or pointed out the patentable distinction between the disclosure in Harmonosky and the claims;

- f) Appellants argue that the Examiner has not shown specificity and concludes that the rejection is improper. Appellants are reminded that the Examiner did make a *prima facia showing*.

The Examiner will now address Appellants' *remaining* arguments which are *germane* to the 112(2) and 102 rejections *(those which are not germane will be linked to the preceding discussion*).

<u>*Response to Arguments- 112(2) - pp. 15-19*</u>

As per Appellants arguments (see pp. 13-14, 15-16, and 18-19; Appeal Brief, for example) relating to alleged misapplication of 112(2) rejections, see item "1" above (namely,

"**1)** ***Appellants have misinterpreted passages from the MPEP.***"). Appellants arguments which are based on this premise are inherently flawed (i.e., responding to the 112(2) rejections as if they were 112(1) rejections - *see, for example, pg. 14 first full paragraph*) and will not be further addressed. *Appellants have generally not addressed the merits of the 112(2) rejections other than to attack the rejections on procedural grounds.*

The Examiner does agree with Appellants arguments (pp. 14, third full paragraph) as they relates to the 112(2) "missing elements" rejections. These rejections have been withdrawn against method claims 41-50.

It is noted that Appellants refer (*pg. 16, last paragraph, apparently in an attempt to traverse a 112(1) rejection which has not been applied*), to lines 5-20, pg. 5 of the specification as it relates to "*determining validity of the Kanban.*" However, the Examiner respectfully submits that said portion does not disclose anything relating to "*determining validity of the Kanban.*"

The comments (*pg. 17, first full paragraph and pg. 18, for example*) are merely argumentative and conclusary. Appellants have not addressed the merits of the rejections. Arguing that a 112(2) should be withdrawn because there is support for certain features (although said support is not specified) in the specification is irrelevant.

The comments (*pg. 17, second full paragraph and pg. 18, for example*) are, again, merely argumentative and conclusary. A rejection was asserted. The Examiner can not respond to arguments if the rejections are not addressed by Appellants.

The comments (*pg. 18*) are, also, merely argumentative and conclusary as it applies to ***intended use***. A rejection was asserted and is recited for convenience:

> **Claims 37-50 provides for the use of *controlling a manufacturing line*, but, since the claim does not set forth any steps involved in the method/process, it is unclear what method/process applicant is intending to encompass.** A claim is indefinite where it merely recites a use without any active, positive steps delimiting how this use is actually practiced. There are no limitations directed at anything more than generation of a schedule.

Consider claim 41, which is exemplary. Claim 41 recites (pg. 52, Appeal Brief):

> **"A method for controlling a manufacturing production line using a virtual kanban system, the method comprising the steps of:**
>
> **storing production line feedback data in a database;**
>
> **inputting said feedback data into a production scheduling model that includes the virtual kanban system and generating an electronic kanban;**
>
> **inputting the electronic kanban and the feedback data to a simulator and simulating the manufacturing production line;**
>
> **determining the validity of the electronic kanban;**
>
> **wherein the feedback data comprises a first data set specifiying a type of equipment in the production line and a second data set specifying at least one of operating status of equipment, product lot status and production inputs status."**

Note that there is no connection between the claimed invention and a real manufacturing system.

- The production line feedback data could be hypothetical. There is no limitation specifying that the data was measured or obtained as it occurred.

- There is no ouput from the simulator to a manufacturing system.

- A manufacturing system has not been claimed.

- Nothing is actually done with the results (after determing validity of the kanban).

Note that nothing is being ***controlled***. **Such a feature is simply not claimed**. In response to applicant's arguments, the recitation *controlling a manufacturing process* has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). Furthermore, in response to applicant's argument that "*Applicant is not claiming a simulation of a Kanban system...*" (pg. 10, paper # 17), a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re*

Otto, 136 USPQ 458, 459 (CCPA 1963). ***Functionally, Applicant has merely claimed a simulator of a production line schedule which uses stored feedback data in its simulation***.

As per arguments pertaining to "apparatus claims" (top of pg. 19, for example), ***Appellants are reminded that there are no apparatus claims - only method and system claims***.

Response to Arguments - 102- pp. 19-49

Appellants' arguments relating to the prior art have been fully considered but they are not persuasive.

Consider claim 41, which is exemplary. Claim 41 recites (pg. 52, Appeal Brief):

> **"A method for controlling a manufacturing production line using a virtual kanban system, the method comprising the steps of:**
>
> **storing production line feedback data in a database;**
>
> **inputting said feedback data into a production scheduling model that includes the virtual kanban system and generating an electronic kanban;**
>
> **inputting the electronic kanban and the feedback data to a simulator and simulating the manufacturing production line;**
>
> **determining the validity of the electronic kanban;**
>
> **wherein the feedback data comprises a first data set specifiying a type of equipment in the production line and a second data set specifying at least one of operating status of equipment, product lot status and production inputs status."**

Note that there is no connection between the claimed invention and a real manufacturing system.

- The production line feedback data could be hypothetical. There is no limitation specifying that the data was measured or obtained as it occurred.

- There is no ouput from the simulator to a manufacturing system.

- A manufacturing system has not been claimed.

- Nothing is actually done with the results (after determing validity of the kanban).

Note that nothing is being ***controlled***. Such a feature is simply not claimed.

For these reasons, the Examiner's position has been that Appellants are disclosing (***in the specification***) ***real-time optimization of a production routing schedule using feedback as input to a simulator***. The Examiner also interprets ***electronic/virtual Kanban to be electronic tracking of items in a manufacturing line***. As per "validity" of the kanban, it is noted that Appellants refer (*pg. 16, last paragraph, Appeal Brief*), to lines 5-20 pg. 5 of the specification as it relates to "*determining validity of the Kanban.*" The Examiner respectfully submits that said portion does not disclose anything relating to "*determining validity of the Kanban.*" However, a reasonable interpretation is that "validity" refers to the existence of a simulation solution that could be implemented. In any case, these concepts been disclosed in the prior art. **Note, however, that Appellants have not even claimed "*real-time*" in claim 41.** Examiner has attempted to point out to Appellants that any disclosure regarding simulation of a Kanban system would read on the independent claims *as they have been drafted*. The claims, as recited, merely claim a simulation -

any art regarding simulation of a Kanban would therefore read on the claims. ***This is precisely the reason for the numerous 102 rejections.***

In response to applicant's arguments, the recitation *controlling a manufacturing process* has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). Furthermore, in response to applicant's argument that "*Applicant is not claiming a simulation of a Kanban system...*" (pg. 10, paper # 17), a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). ***Functionally, Applicant has merely claimed a simulator of a production line schedule which uses stored feedback data in its simulation***.

Also note Applicants statement (second paragraph, pg 23, Appeal Brief), recited for convenience:

"The simulator of De Toni is **NOT** the simulator recited in claims 23 and 41, which simulates operation of the production line and receives as input the electronic kanban from the production scheduling model."

Note that this states that the production line is simulated. It further states that the input comes from a model, not real data. ***In other words, Appellants only claiming a simulation of a production line which inherently includes simulation of tracking of manufacturing items and machines.*** Appellants also appear to be arguing or implying that the model is somehow separate from the simulation. The Examiner, respectfully, is not persuaded by such reasoning. It is inherent in simulations that the simulator must be initialized before it can be run. The "input" from the ***model*** is the ***initialization*** of the ***simulation***. ***The Examiner respectfully does not see the patentable distinction between Appellants claimed invention and the simulation of a kanban system.***

Note that the Examiner interprets claim 41 as follows (taking into account the above discussions):

"A method for simulating a production line which uses an electronic tracking system, the method comprising the steps of:

storing production line feedback data in a database;

inputting said feedback data into a production scheduling model that includes the electronic tracking system and generating electronic data about the tracked items;

inputting the electronic item tracking data and the feedback data to a simulator and simulating the manufacturing production line;

determining if a solution to the simulation exists;

wherein the feedback data comprises a first data set specifiying a type of equipment in the production line and a second data set specifying at least one of operating status of equipment, product lot status and production inputs status."

Jain et al. disclose "*Expert Simulation For On-line Scheduling.*" They further disclose that, in recent years, the automotive industry has realized the importance of speed of new products to market and has mounted efforts for improving it. ***The Expert System Scheduler (ESS) facilitates these efforts by enabling manufacturing plants to generate viable schedules under increasing constraints and demands for flexibility. The scheduler takes advantage of the Computer Integrated Manufacturing (CIM) environment by utilizing the real-time information from the factory for responsive scheduling. The Expert System Scheduler uses heuristics developed by an experiences factory scheduler. It uses simulation concepts and these heuristics to generate schedules. Forward and "backward" simulation are used at different stages of the schedule generation process. The system is used to control parts flow on the factory floor at one automated facility. The scheduling computer is networked to the factory control computer, which actually controls the plant floor.*** The TI Explorer II acquires current plant floor information from the factory control system, generates a new schedule and sends it back within a short time. The configuration allows fast response to changes in

requirements and plant floor conditions. See section 2 (expert systems approach); section 3 (use of simulation); and fig. 1-2 (implementation of combined on-line system).

Liberatore et al. disclose "*Dynamic allocation of kanbans in a manufacturing system using perturbation analysis.*" They further disclose an application of perturbation analysis techniques to the problem of dynamic allocation of buffering capacity in a multipart-type manufacturing system. The problem is of extreme interest, among others, in kanban systems. The first contribution of the paper consists of a formulation of the generation function for the case of buffer size perturbation. *The second contribution consists of an online control strategy, aimed at dynamically varying the buffering capacity of the working centres, in order to keep the performance of the system as high as possible, despite unknown disturbances entering the system. The proposed control strategy has been tested by means of simulation on a multipart-type kanban system.* The control action consists of dynamically varying the number of kanbans associated to each part-type, in order to counteract the effect of unknown changes in the product-mix on the system throughput. See section 1 which discusses an on-line control strategy (developed in section 4).

Umeda discloses in section 6 (*ADVANCED SIMULATION SYSTEM FOR PRODUCTION PLANNING AND CONTROL SYSTEM*) that thus far, the author have suggested a manufacturing system simulator. In this section, Umeda proposes an advanced simulation system, which includes the above simulator as its a kernel module. It also includes a graphic post-processor, a model generator, and a schedule evaluator. A system configuration is shown

in Figure 9. The graphic post-processor supports graphic charts which represent the output analysis data of simulation. The model generator gets both the system configuration and the manufacturing schedules, and generates the simulation model automatically, The schedule evaluator provides the facility of manufacturing scheduling simulation. *There exist two types of manufacturing simulation to support planning and control operations in a factory off-line simulation and* ***on-line simulation***. The former is an assessment at design and planning stages. Manufacturing engineers mainly discuss the system configuration, such as buffer size, machine capacity, vehicle speed and others. This operation supports the analysis works such as systems planning or line improvement. These works require simulation independently on daily manufacturing operations. ***On the other hand, the on-line simulation supports the daily plant control operations. The main input parameters of the on-line simulation are daily manufacturing schedules.*** MPSIMRP produces the daily manufacturing schedules at production planning phase. While, planning changes or line-troubles often occur in daily manufacturing practice. Accordingly, manufacturing field workers require so-called re-scheduling operations to synchronize their field works with the plans. Re-scheduling operation requires special skill of operators. Furthermore, it takes much time to select one among many possible schedules. ***Repeats of simulation with different scheduling parameters will support such real-time re-scheduling operation. This operation requires a high performance of simulation, and dynamic changes of the simulation parameters in real-time scale.*** The model generator and the schedule evaluator will provides such works. The former directly rewrites

the manufacturing schedules in the simulation model, such as the shipment orders lists and part-throw lists, and the later estimates whether the given schedule is executable or not. ***"Virtual Plant System" is a concept which combines real-time monitoring system with on-line factory simulation by computer network (Figure. 10). The real-time monitoring system observes all the data of main activities at each plant layec such as production orders, venders actions, WIPS changes, machine-downs, and others. And, it periodically sends these data to the parameters generator. The parameters generator transfers them to simulation parameters, and send them to the on-line factory simulator, which has a hierarchical model of multiple lines or sections. Thus, the simulator can realize the same situation as the actual plant by the latest information. While, a planning system such as MPSIMRP sends the plant control information to both the actual plant and the virtual plant. In this environment, simulation can realize the same material flow and information flow as the actual plant in computer. Such environment will enable manufacturers to predict the key events of plant, whenever a new direction is performed. This will be a great support for manufacturers to make decisions in plant operations***. See pg. 892 (Kanban, Pull); section 2.4 (Siman); section 6 (real-time simulation and process control).

Krishnamurthi et al. disclose the state of the prior art regarding on-line simulation in section 2 (*PAST RESEARCH ON ON-LINE SIMULATION SYSTEMS*). The major components of on-line simulation systems discussed in the existing literature generally consist of a data acquisition module, a simulation model and a control program. Additional features such as

expert systems and knowledge bases are also included in some on-line simulation systems. Past research in on-line simulation has focused mainly on production scheduling and monitoring and control and they are briefly discussed in the following sections. Section 2.1 discloses *On-Line Simulation for Real-Time Scheduling*. A ***major portion of the past research has been on on-line real-time scheduling of manufacturing systems. Rogers and Flanagan (199 1) have developed a framework for an on-line simulation system for real-time scheduling. The on-line simulation system gets shop floor status, material plan and planning options and evaluates the performance of these options. The output is analyzed by production control personnel or an expert system to come up with the best alternative. This framework is applicable for real-time scheduling in manufacturing industries. Jain et al. (1989) used an on-line simulation system in the development of an Expert System Scheduler. The framework used in this system consists of an Expert System Scheduler and a Factory Control System. The scheduling computer acquires shop floor information from the factory control computer, generates a new schedule based on simulation runs and sends it back to the factory control computer. The factory control computer interacts with the shop floor, materials department and the marketing department to get the necessary input and to send the new schedule. The simulation models have been developed using LISP and they use backward chaining concept to go from the desired output to the necessary input. On-line simulation was used in a work order release mechanism for a flexible manufacturing system developed by Muller et al. (1990). The framework of this system consists of a simulation***

model and a control system interface. The simulation model acquires necessary data directly from the databases. The model is run by the control system interface for a spectiled time window to find the effect of various order release policies. The analyst selects the best schedule based on simulation results. The simulation model was written in SIMAN and the data interfaces were developed in FORTRAN. Section 2.2 discloses On-Line Simulation for Monitoring and Control. On-line control of a manufacturing cell was achieved by Manivannan and Banks (1991). The framework of this system contains knowledge bases, databases, simulation models and control interfaces. The model monitors the cell continuously and the user initiates the system emulation any time a control decision is needed, A knowledge base is used to selectively simulate alternatives for which prior knowledge does not exist. The simulation models are written in SIMAN and the knowledge bases are written in LISP. Based on this system, Manivannan and Banks have come up with a design for a knowledge-based on-line simulation system to control a manufacturing shop floor. Manivannan and Banks (1990) have also developed an on-line knowledge based simulation system for diagnosing machine tool failure. The framework of this system is similar to the previous system. The data from sensory devices is analyzed by a controller and thesimulation model is used to calculate the time of failure of machine tool whenever an impending failure is sensed. A knowledge base stores the results which are used for eliminating simulation runs if prior knowledge exists. On-line simulation systems have also been used in other applications such as signalized intersection control for evaluating various

signal control strategies by Chang (1989), and in developing efficient and flexible operations and training of air tratlic control trainees by Kornecki et al. (1991). See fig. 1-3.

Manivannan et al. disclose "***Real-time control of a manufacturing cell using knowledge-based simulation.***" They further disclose that the need for integrated simulation environments for modeling and analysis is advanced. **A mathematical framework based on higher-level abstractions representing entities, attributes, constraints, and other components of manufacturing cells is presented. A manufacturing cell has been modeled to illustrate the framework and real-time control issues using knowledge-based simulation. A temporal knowledge base has been designed to synchronize the events and their times of occurrence in both the manufacturing cell and the simulation model. A dynamic knowledge base has been implemented using frame structures for storing the results of simulation.** This feature provides a faster response to a control problem by reducing the number of resimulations conducted for evaluating various alternative policies in real time. The proposed real-time knowledge-based simulation system has been applied to a manufacturing cell connected to a variety of materials handling systems. See fig. 1 & 6 (real-time control, feedback and simulation).

De Toni et al. disclose "*An artificial, intelligence-based production scheduler.*" They further disclose a ***production scheduler, which utilizes a hybrid push/pull approach to scheduling and exploits the expert system technology in order to obtain satisfactory solutions.*** The scheduler is applied to a multi-stage production and inventory system, managed

by make-to-order, with a large variety of incoming orders. The search for solution is made in respect of the due-dates and under efficiency constraints (minimum lot, maximum storehouse levels, etc.). Considers order aggregation, both at portfolio and production level. ***Provides a dynamic rescheduling mechanism***. Outlines theoretical arguments in favour of the scheduler and notes practical advantages as a consequence of the application of the scheduler in a firm which utilized a traditional despatching system. Page 23 discloses "*The expert system solution*". Several outlines regarding expert system applied to production scheduling have been made [19, 20]; some complete schedulers have been constructed (ISIS is probably the most famous expert system for scheduling) and in the literature there are detailed comparisons [21]. A decision support system (DSS) solution has been proposed too [22]. At other times the simple weakness of traditional approaches has been remarked on [23,24]. ***Particular attention is dedicated to the possibility of an effective rescheduling (or dynamic scheduling) [25-28].*** The advantages of the expert system technology in scheduling have been noted by several researchers [29,30] and can be summarized as the possibility of a selective relaxation of the constraints and the use of heuristics to restrict the number of alternatives and assist in selecting the best solution. Resorting to sub-optimal solutions (typical of the expert systems) is necessary since little advance has been made towards finding optimal solution procedures for models of a realistic size. Carrying out research on sub-optimal solutions using heuristic rules would lead to very interesting results [31]. This scheduler is original in the application of a hybrid pull/push approach (rising step profile + supplementary load) by an expert system. The

scheduler has a constraint-directed chaining (according to the five classes described by Kusiak[32]: hierarchical, non-hierarchical, script-based, opportunistic and constraint-directed); constraints provide guidance and bounds in the search for good schedules. This scheduler uses some blackboard techniques of the type hypothesized by Hayes-Roth [33]. The production scheduling black-board consists of frames, lists and rules of the IF/THEN type, plus a blackboard controller with a shopfloor control system interface and codes/routeings archives. The status of the work centres, the backlogs and the functional parameters are described by frames; the status of the storehouses and of the order portfolio are instead in the form of lists. The reasoning logic is described by about 200 rules, in lisp-like language. For production scheduling problems, the main advantage of a blackboard control is simplicity of rule drafting and their insertion into the knowledge base, without having to be placed at a precise point in the knowledge base and solely as an enrichment of the knowledge base itself, on which the inferential engine acts. See pp. 22-23 (hybrid push/pull approach); pg. 23 (expert system).

Umeda et al. teaches simulation of a Kanban system. See entire disclosure and particularly: abstract; figs. 1-15; col. 1, lines 42-55; col. 3, lines 48-67; col. 3, lines 1-48; col. 10 lines 1-67; col. 18, lines 10-67.

Seppanen teaches: "Kanban Simulator using Siman and Lotus 1-2-3." See particularly: abstract; and pp. 838-844.

Wiwakanond et al. teach "Simulation of Electronics Manufacturing Systems with Two-Card Kanban." See particularly: entire disclosure.

Corbett et al. disclose a review of papers concerning simulations of scheduling systems, including Kanban systems. See particularly: abstract; sections 2-3, and list of references.

Tantry et al. disclose "*Object-oriented architecture for factory floor management.*" The abstract discloses: "*An object-oriented architecture for a factory floor management software system is described in which factory floor entities are modelled as factory objects within a relational database. The architecture includes X-terminal or bar code devices for facilitating user interaction with the system via one or more of the factory floor entities; Application Engines for processing user interaction of events and generating application service requests; and Application servers for processing the application service requests and generating database service requests in response. These database service requests are utilized to retrieve, manipulate and update data stored within the relational database. Communication Managers are employed for coordinating interprocess communication between the Application Engines, the Application Servers, and the Database Servers. Each of these major components are distributed among computer resources that are networked across the factory floor.*" See, also: fig. 2-3, 5-10; col. 1, line 38 to col. 2, line 46; col. 5, line 45 to col. 9, line 30; Table 1 (col. 20).

Natarajan discloses (abstract): "*A conceptual decision analysis tool for production dispatch process is used to evaluate alternatives during a production process and generate an optimum path to follow after a process disruption at a given production center in order to maintain the promised due date. The objective is not only to decide on a dispatch rule to be*

followed for an order under progress at a given work center in the event of a disruption, but also to re-analyze dispatch rules for existing orders waiting in line to be processed at that work center. In the event of production stoppage or disruption, this system analyzes the revised sequence for orders in progress as well as passes the recommended results to a planning system so that this information can be used to re-plan the release sequence of orders waiting for release. This provides a feedback control mechanism and an element of artificial intelligence." See, also: fig. 2-3; col. 2, line 26 to col. 3, line 10.

Parad discloses (abstract): "*A method for continuous real-time management of heterogeneous interdependent resources is described. The method preferably comprises using multiple distributed resource engines to maintain timely and precise schedules, and action controls, and identifying and responding to rapidly changing conditions in accord with predetermined requirements, relationships, and constraints. Each resource engine continuously adjusts schedules in response to changing status, resource requirements, relationships and constraints. Each action control maintains an ordered list of conditions requiring action, determines the best action in each case, and generates appropriate responses. Preferably methods for continuous operation include inquiring about status concurrent with scheduling activity and recognizing the effects of time passage on the condition of schedules.*" See, also: fig. 1-2, 6, 8-9, 11-12, 17-19; col. 2, line 1 to col. 5, line 64.

Korncoff et al. discloses (abstract): "An exception *processing system for use in conjunction with manufacturing facilities, and automated manufacturing cells in particular is*

provided. The exception processor is adapted to receive alarms from a cell controller indicating that an unplanned event or exception has occurred in cell operation. The exception processor implements an automated recovery procedure that responds to the alarm, corrects the exception, and returns the cell to normal operation. The exception processor also statistically monitors cell operation in order to avoid exceptions before they occur, and to provide better control over cell processes." See, also: fig. 1-2, 5, 7, 12, col. 1, lines 24-46; col. 2, line 1 to col. 4, line 23.

Weaver et al. discloses (abstract): "This invention is a look-ahead method for determining *optimum production schedules* for each production step based on factory-wide monitoring of in-process part queues at all potential production bottlenecks. For each product having associated therewith a throughput bottleneck, a maximum queue quantity Q.sub.MAX and a minimum queue Q.sub.MIN quantity are assigned. When a machine completes a lot of a particular product at a production step P that proceeds the bottleneck step B, the *look-ahead method* is initiated. The queue at step P is searched and the next lot to be processed is selected. *If that lot is a product for which Q.sub.MAX and Q.sub.MIN values have been assigned at step B, then the queue quantity at step B is determined. If, on one hand, the queue quantity at step B is less than Q.sub.MAX, or between Q.sub.MAX and Q.sub.MIN and the queue quantity is climbing upward from a sub-Q.sub.MIN value and has not yet exceeded its Q.sub.MAX value, then the lot is processed without further analysis. If, on the other hand, the queue quantity at step B is greater than Q.sub.MAX, or between Q.sub.MAX and Q.sub.MIN and the queue*

quantity is descending from a quantity greater than its Q.sub.MAX and has not yet fallen below its Q.sub.MIN value, then that product has a set flag status associated therewith, and the lot will not be processed until after all other lots which have a clear flag status are processed." See, also: fig. 3; col. 1, line 16 to col. 2, line 26.

Lee et al. discloses a lookahead production planning system. The abstract discloses: "*An integrated manufacturing system operative for managing the distribution to a factory floor as well as throughout a factory of the information that is necessary to effectuate the production of products on the factory floor. The information required for this purpose encompasses, but is not necessarily limited to, both the design information which is generated within the engineering enterprise and the scheduling information which is generated within the manufacturing resource planning system. This information consisting of design and manufacturing data pertaining to the product to be produced is in turn stored in a central repository for all shared information from whence as needed it is capable of being distributed in a logical and efficient fashion through operation of the integrated manufacturing system to the factory floor as well as throughout the factory so as to thereby enable the product to be produced on the factory floor in a most timely and most cost-effective manner.*" See, also: fig. 1, 3-4, 6, 15-16, 18-20, 23-28; col. 3, line 60 to col. 6, line 27.

Roberts et al. discloses in section 5 (*CONTROL SPECIFICATION SIMULATION ASSISTANT*) that often control code errors am not detected until the code is tested on the actual process. On-line validation can be extremely costly since process equipment must be out of

production during the testing process. An alternative solution is to use computer simulation to reduce the validation time. Computer simulation for control code validation can also be very costly to perform. A simulation model must be created which can interact with the actual control specification. Inputs to the system must be analyzed and distributions formed. It is also desirablè to have some inputs that the operator controls. Controls such as push buttons, levers, dials in the actual system need to be represented and available for input to the simulation. The operator of the simulation model must also be able to provide these inputs in a pseudo real-time mode. Fortunately, part of the simulation specification is already available. The physical specification of the virtual plant and the process specification already contain information that is needed for the simulation model. As has been mentioned, each piece of equipment has an object oriented sofhvare map called an instance. The object oriented approach allows us to add functionality to the object for simulation purposes. For example, we may have an instance of a mixing tank. This mixing tank instance has a data structure for current level and for its own iconic representation. The encapsulated procedure for the mixing tank object will include the ability to display itself and the ability to display its current level. The control simulation is conducted using a next event calendar and the keyboard for system inputs. Many inputs are modeled with distributional functions, however, many of the inputs to the model come from a manual input source. To achieve this the inputs are tied to the keyboard with the aid of the control specification simulation assistant. A pseudo real-time simulation is maintained using fixed time increment updates generated by the computer clock. This update scheme gives the

user the ability to interact dynamically by evoking system events. With each time increment the calendar is also checked for scheduled mndom events. *As new input events occur, the simulation assistant processes the changes in system states and maps these states to the generic control code specification produced by the control code generator assistant. System states are updated based on the specification by sending messages to the equipment instances.* The equipment instances receive these messages and update their own internal states which are then displayed on the monitor. See fig. 1; section 5 (control specification simulation assistant).

Bouchentouf-Idriss et al. disclose that the absence of CASE tools for software-development of distributed cooperative systems is the major roadblock to effective use of concurrent processing. This paper presents a manufacturing engineering application, a concurrent cooperative processing model of this application, and the Server Network Generator (SNG) CASE tool that was used to *design and implement it as a distributed software system* in APL2, using inter-user shared variables. The application is a Japanese manufacturing control strategy called the "*Kanban System.*" See pp. 62-66 (Kanban); pp. 66-68 (electronic Kanban, emulation);

Harmonosky discloses in section 2 (SIMULATION INTERFACED WITH THE PHYSICAL SYSTEM) that in most of the reported research using ***simulation for real-time scheduling, the simulation is assumed to be interfaced with the physical system in some manner. Figure 1 presents a typical viewpoint for the interface for exeeption real-time scheduling, which could be easily modified for continuous real-time scheduling. Data***

regarding system status updates the simulation initial conditions when a decision is needed, either on an exception basis or continually. If alternatives exist, each would be simulated and the best could be selected, or the simulation would be run to predict future problems. The research discussed in this section uses this basic interfacing theme with a few variations. ***Harmonosky also reviews the prior art concerning Continuous Real-Time Scheduling Approaches*** in section 2.1. Continuous real-time scheduling refers to the case where every decision regarding which task to schedule next is made as needed as time moves forward in the physical system. ***Krishnamurthi and Vasudevan (1993) present a framework for a domain-based on-line simulation, which they suggest could be used as a general purpose decision support system***. The objective is to create something general to all problems within a specific domain where the simulation is continuously monitoring the real system so that it always reflects current system state. Their framework consists of several modules a simulation module, a simulation control module, static and dynamic databases, a data acquisition module, and a customization module. A prototype is developed for the domain of a single queue with multiple parallel servers. The objective is to determine the number of parallel servers to minimize queue length and waiting time as system conditions change over time. ***The prototype uses Turbo C to pass data between computers, the SIMAN simulation language and the CLIPS expert system as a knowledge base to check if a prior decision exists that can be used without a new simulation. The time saved by the developed prototype system was 3070 of the time taken by an off-line simulation process. Smith et al. (1994) use simulation as a task***

generator in addition to an analysis and evaluation tool. A simulation of the physical system acts as adecision maker determiningwhat task must occur next and sends that task to the execution software for the system. Using simulation as a shop floor control mechanism was developed as part of a larger joint project, RapidCIM, with Texas A&M University, Penn State University, and Systems Modeling Corporation. This project's overall objective is to reduce the time required to develop fully functional shop floor control systems for flexible discrete parts manufacturing. Consequently, the control logic developed and used for the simulation becomes the physical system's control system, reducing time between the simulation analysis phase and physical system implementation. Special features of the Arena/SIMAN simulation language are used to enable direct interfacing with physical system data and to enable switching the simulation between off-line analysis mode and on-line task generator mode. The reported control svstem is deveioped for Texas A&M's Computer' Aided Manufacturing lab and Penn State's CIM lab where it provides direct continuous control of shop activities. Currently, the system does not evaluate several alternative tasks at each decision point. However, the authors do suggest that it could be used to evaluate multiple alternatives by making a copy of the simulation that can be initialized with the current physical system state and run into the future. Duffie and Prabhu (1994) present a heterarchical manufacturing system that uses simulation to evaluate local schedules that are continually developed by local controllers. The system has loosely coupled, highly autonomous entities having minimal global information. All entities develop their own local schedule and

"cooperate" to meet global goals. The local and global merits of these local schedules are evaluated by a simulation that is developed by modifying the physical systems control software. See fig. 1.

Marriott discloses in section 1.1 (*TRADITIONAL SCHEDULING*) that without computer based scheduling most plants will plan production one of two ways, either they will generate schedules by hand, or will not schedule and run by means of "Hot-Lists". When the detail schedule is created by hand it is usually done on a magnetic board or drawn on paper. For all but the most simple sites, the time required to do this is prohibitively large unless short cuts are taken. These schedules usually take the form of a Gantt chart so a scheduler can quickly analyze the volume ofinformation involved. The use of a Gantt chart also highlights the time dependent nature of the scheduling process. Most manufacturing consists of several consecutive operations that are defined for a part. These operations must be performed sequentially using one or more manufacturing resources. The availability of the PROVISA (Production Visual Interactive Scheduling Aid) is a finite capacity scheduling system geared for manufacturing facilities. While the mechanisms behind PROVISA are based upon AT&T ISTELS simulation technology there are several features that differentiate a simulation based scheduling system from a general purpose simulator. A general purpose simulator is usually a model centric tool. The purpose of the system is to analyze how the model performs. It is normally used by modifying how the model works. To initialize the model a warm-up period based on statistical generalizations may be used. The system uses a stochastic simulation

engine to generate the variability in the output that is useful for analysis (with a confidence level after a number of runs). These simulation models usually have a finite life, when the analysis is complete the model is rarely used again, A simulation based scheduling system is data centric. ***A scheduler must produce specific items that will fulfill some demand. To initialize the model the actual status from the plant floor must be used. A scheduling system must produce a "good" solution in a minimum time in order to be effective. This leads a simulation based scheduling system to use a deterministic model instead of a stochastic one.*** In addition, the benefits of a statistical based output do not fit into the scheduling environment. As an example, breakdowns generally occur in a random fashion. Since the exact time that a breakdown will occur is impossible to predict, it is impossible to schedule. In this case, it is better to generate a schedule based upon the best data available, and reschedule when and if the breakdown occurs. Lastly, a scheduling model has a much longer life than a simulation model. A scheduling model is expected to survive for many years of daily use with little or no modification. While both types of systems encourage "What-if' experimentation, a scheduling system is working with tangible things while a simulation package models things that "could be". These differences between the two highlight the mode in which they are applied. When used for scheduling the simulation is tactical, however when it is used for simulation it is strategic. Section 3 (*ELEMENTS FOR SCHEDULING*) discloses that for a scheduling system to be a useful tool it must be able to do the same functions as the manual scheduler. Specifically, it must generate the expected start and completion dates for the operations that

are to be performed and it must able to analyze this data to determine its acceptability. To perform these functions the scheduling system needs to provide several capabilities:

- Incorporate the logic of how a site produces its goods.

- Handle any manufacturing mechanisms that the site uses, for example, JIT, ***Kanban***, Theory of Constraints.

- Provide flexibility when unexpected conditions arise.

- Help the scheduler analyze the resultant schedule to determine the desirability of the schedule.

- Create an output of the schedule that is useful in the operational environment.

To accomplish this, PROVISA is organized as shown in Figure 1. The data is manipulated through the simulation engine. The resultant data is analyzed through generated reports, and the Comparison and Planning Board modules. If the first schedule is not satisfactory then PROVISA offers several options that allow refinement through iteration. See fig. 1 & 4.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Dr. Hugh Jones HJ

September 9, 2001

Conference

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER

Ronald P. Kananen

Rader, Fishman & Grauer, PLLC

Lion Building

1233 20th Street, N.W.

Washington, D.C. 20036